day 21

3.1/63

$$f(x)=\begin{cases}2x^2 & ,x\le 1\\ ax-2 & ,x>1\end{cases}$$

Given

$f(x)$ is continuous at $x=1$

- $f(1)$ exists
- $\lim_{x\to 1} f(x)=2$

$$\lim_{x\to 1^+} f(x)=\lim_{x\to 1^+} ax-2 = a-2$$

$$\lim_{x\to 1^-} f(x)=\lim_{x\to 1^-} 2x^2 = 2$$

$a-2=2;\ a=4$

$\lim_{x\to 1} f(x)$ exists ONLY when $a=4$

- $f(1)=2=\lim_{x\to 1} f(x)$

day 21

3.1/58

$$\lim_{h \to 0} \frac{\sqrt{2+h} - \sqrt{2}}{h}$$

If this is a derivative $f'(a)$, what is $f(x)$ and what is a?

$$f'(a) = \lim_{x \to a} \frac{f(x) - f(a)}{x - a}$$

$$f'(a) = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h}$$

$f(x) = \sqrt{x}$ &

$a = 2$

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

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day 21

3.2/17 explain why or why not.

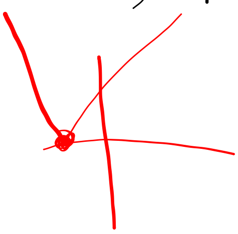
a) if the function is differentiable for all x, then f is continuous for all x.

theorem TRUE

A function $f(x)$ is differentiable on an open interval (a,b) iff $f(x)$ has a derivative at every x in (a,b).

+ left-diff and right-diff

b) The function $f(x) = |x+1|$ is continuous for all x, but not differentiable for all x

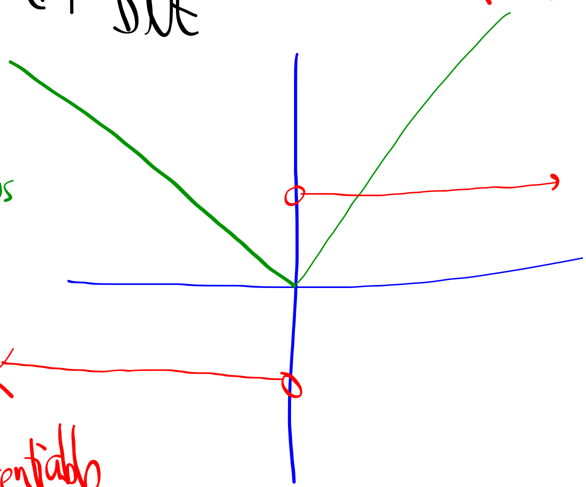


$|?| = 0$

0

so ricochet happens when $x+1=0$

$\lim_{x \to -1} f'(x)$ DNE



$f(x)$ = differentiable on $(-\infty,0)$ and on $(0,\infty)$

and NOT differentiable at $x=0$

day 21

3.2 17c) It is possible for the domain of f to be (a,b) and the domain of f' to be $[a,b]$

LEFT what would it mean to be differentiable at $x=a$?

If $f'(x)$ is differentiable at a, then it would HAVE to be continuous at a.

RIGHT

$f(x)$ is diff from the RIGHT at $x=a$ iff

$\lim_{x \to a^+} \frac{f(x)-f(a)}{x-a}$ exists.

"contradiction"

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day 21

3.2/21 Find an equation of the normal line

$y = 3x - 4$; $P = (1, -1)$

slope of tangent line $= 3$

slope of line perpendicular to this is . . . . . . $-\frac{1}{3}$

$pt = (1, -1)$

so . . . . .

$y - (-1) = -\frac{1}{3}(x - 1)$

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